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Barnase and binase: Twins with distinct fates

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Abstract

RNases are enzymes that cleave RNAs, resulting in remarkably diverse biological consequences. Many RNases are cytotoxic. In some cases, they attack selectively malignant cells triggering an apoptotic response. A number of eukaryotic and bacterial RNase-based strategies are being developed for use in anticancer and antiviral therapy. However, the physiological functions of these RNases are often poorly understood. This review focuses on the properties of the extracellular RNases from Bacillus amyloliquefaciens (barnase) and Bacillus intermedius (binase), the characteristics of their biosynthesis regulation and their physiological role, with an emphasis on the similarities and differences. Barnase and binase can be regarded as molecular twins according to their highly similar structure, physical-chemical and catalytic properties. Nevertheless, the 'life paths' of these enzymes are not the same, as their expression in bacteria is controlled by diverse signals. Binase is predominantly synthesized under phosphate starvation, whereas barnase production is strictly dependent on the multifunctional Spo0A regulator controlling sporulation, biofilm formation and cannibalism. Barnase and binase also have some distinctions in practical applications. Barnase was initially suggested to be useful in research and biotechnology as a tool for studying protein-protein interactions, for RNA elimination from biological samples, for affinity purification of RNase fusion proteins, for the development of cloning vectors and for sterility acquisition by transgenic plants. Binase, as later barnase, was tested for antiviral, antitumour and immunogenic effects. Both RNases have found their own niche in cancer research as a result of success in targeted delivery and selectivity towards tumour cells. A number of eukaryotic and bacterial RNase-based strategies are being developed for use in anticancer and antiviral therapy. However, the physiological functions of these RNases are often poorly understood. Barnase and binase can be regarded as molecular twins according to their highly similar structural, physical-chemical and catalytic properties. Nevertheless, their expression in bacteria is controlled by diverse signals. © 2011 FEBS.

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Keywords

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